

CLAIMS

1. Apparatus for determining a measure of image quality of an image, comprising:
  - 5 means for determining a blockiness invisibility measure of the image;
  - means for determining a colour richness measure of the image;
  - means for determining a sharpness measure of the image; and
  - means for providing the measure of image quality of the image based on the blockiness invisibility measure, the colour richness measure and the sharpness measure of the image.
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2. Apparatus according to claim 1, wherein the means for determining the colour richness measure of the image is operable to provide the colour richness based on the sum of the products of the probabilities of colour values and the logarithms of those probabilities.
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3. Apparatus according to claim 1 or 2, wherein the means for determining the sharpness measure of the image is operable to provide the sharpness based on the sum of the products of the probabilities of differences between neighbouring portions of the image and the logarithms of those probabilities.
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4. Apparatus according to claim 3, wherein the differences between neighbouring portions of the image are differences in colour values.
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5. Apparatus according to claim 3 or 4, wherein the differences between neighbouring portions of the image are differences in image data between neighbouring pixels.
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6. Apparatus for determining a blockiness invisibility measure of an image, comprising:
  - means for averaging differences in colour values at block boundaries within the image;

means for averaging differences in colour values between adjacent pixels; and

means for providing the blockiness invisibility measure based on averaged differences in colour values between adjacent pixels and averaged differences in colour values at block boundaries within the image.

7. Apparatus for determining a colour richness measure of an image, comprising:

means for determining the probabilities of individual colour values within the image;

means for determining the products of the probabilities of individual colour values and the logarithms of the probabilities of individual colour values; and

means for providing the colour richness measure based on the sum of the products of the probabilities of individual colour values and the logarithms of the probabilities of individual colour values.

8. Apparatus for determining a sharpness measure of an image, comprising:

means for determining differences in colour values between adjacent pixels within the image;

means for determining the probabilities of individual colour value differences within the image;

means for determining the products of the probabilities of individual colour value differences and the logarithms of the probabilities of individual colour value differences; and

means for providing the sharpness measure based on the sum of the products of the probabilities of individual colour value differences and the logarithms of the probabilities of individual colour value differences.

30 9. Apparatus according to any one of claims 1 to 5, wherein the means for determining a blockiness invisibility measure of the image comprises apparatus according to claim 6.

10. Apparatus according to any one of claims 1 to 5 and 9, wherein the means for determining a colour richness measure of the image comprises apparatus according to claim 7.

5 11. Apparatus according to any one of claims 1 to 5, 9 and 10, wherein the means for determining a sharpness measure of the image comprises apparatus according to claim 8.

10 12. Apparatus for determining a measure of image quality of an image within a sequence of two or more images, comprising:  
apparatus according to any one of claims 1 to 5 and 9 to 11; and  
means for determining a motion activity measure of the image within the sequence of images.

15 13. Apparatus for determining a motion activity measure of an image within a sequence of two or more images, comprising:  
means for determining differences in colour values between pixels within the image and corresponding pixels in a preceding image within the sequence of images;  
means for determining the probabilities of individual colour value differences between the image and the preceding image;  
means for determining the products of the probabilities of individual colour value differences and the logarithms of the probabilities of individual colour value differences; and  
20 means for providing the motion activity measure based on the sum of the products of the probabilities of individual colour value differences and the logarithms of the probabilities of individual colour value differences.

25 14. Apparatus according to claim 12, wherein the means for determining a motion activity measure of the image within the sequence of images comprises apparatus according to claim 13.

15. Apparatus according to claim 12 or 14, wherein the means for providing the measure of image quality of the image is operable to provide the image quality measure further based on the motion activity measure of the image.

5 16. Apparatus for determining a measure of video quality of a sequence of two or more images, comprising:

apparatus according to any one of claims 1 to 5, 9 to 12, 14 and 15; and means for providing the measure of video quality based on an average of the image quality for a plurality of images within the sequence of two or more images.

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17. Apparatus according to any one of the preceding claims, operable to make the determination without reference to a reference image.

15 18.

A method of determining a measure of image quality of an image, comprising:

determining a blockiness invisibility measure of the image;

determining a colour richness measure of the image;

determining a sharpness measure of the image; and

20 providing the measure of image quality of the image based on the blockiness invisibility measure, the colour richness measure and the sharpness measure of the image.

19. A method according to claim 18, wherein determining the colour richness measure of the image comprises providing the colour richness based on the sum of the products of the probabilities of colour values and the logarithms of those probabilities.

20. A method according to claim 18 or 19, wherein determining the sharpness measure of the image comprises providing the sharpness based on the sum of the products of the probabilities of differences between neighbouring portions of the image and the logarithms of those probabilities.

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21. A method according to claim 20, wherein the differences between neighbouring portions of the image are differences in colour values.
22. A method according to claim 20 or 21, wherein the differences between 5 neighbouring portions of the image are differences in image data between neighbouring pixels.
23. A method for determining a blockiness invisibility measure of an image, comprising:
  - 10 averaging differences in colour values at block boundaries within the image;
  - averaging differences in colour values between adjacent pixels; and
  - providing the blockiness invisibility measure based on averaged differences in colour values between adjacent pixels and averaged differences in colour values at block boundaries within the image.
24. A method for determining a colour richness measure of an image, comprising:
  - 20 determining the probabilities of individual colour values within the image;
  - determining the products of the probabilities of individual colour values and the logarithms of the probabilities of individual colour values; and
  - providing the colour richness measure based on the sum of the products of the probabilities of individual colour values and the logarithms of the probabilities of individual colour values.
25. A method for determining a sharpness measure of an image, comprising:
  - 30 determining differences in colour values between adjacent pixels within the image;
  - determining the probabilities of individual colour value differences within the image;
  - determining the products of the probabilities of individual colour value differences and the logarithms of the probabilities of individual colour value differences; and

providing the sharpness measure based on the sum of the products of the probabilities of individual colour value differences and the logarithms of the probabilities of individual colour value differences.

5 26. A method according to any one of claims 18 to 22, wherein determining a blockiness invisibility measure of the image comprises a method according to claim 23.

10 27. A method according to any one of claims 18 to 22 and 26, wherein determining a colour richness measure of the image comprises a method according to claim 24.

15 28. A method according to any one of claims 18 to 22, 26 and 27, wherein determining a sharpness measure of the image comprises a method according to claim 25.

20 29. A method for determining a measure of image quality of an image within a sequence of two or more images, comprising:  
a method according to any one of claims 18 to 22 and 26 to 28; and  
determining a motion activity measure of the image within the sequence of images.

25 30. A method for determining a motion activity measure of an image within a sequence of two or more images, comprising:  
determining differences in colour values between pixels within the image and corresponding pixels in a preceding image within the sequence of images;  
determining the probabilities of individual colour value differences between the image and the preceding image;  
determining the products of the probabilities of individual colour value differences and the logarithms of the probabilities of individual colour value differences; and

providing the motion activity measure based on the sum of the products of the probabilities of individual colour value differences and the logarithms of the probabilities of individual colour value differences.

- 5 31. A method according to claim 29, wherein determining a motion activity measure of the image within the sequence of images comprises a method according to claim 29.
- 10 32. A method according to claim 29 or 31, wherein providing the measure of image quality of the image comprises providing the image quality measure further based on the motion activity measure of the image.
- 15 33. A method for determining a measure of video quality of a sequence of two or more images, comprising:
  - a method according to any one of claims 18 to 22, 26 to 29, 31 and 32; and
  - providing the measure of video quality based on an average of the image quality for a plurality of images within the sequence of two or more images.
- 20 34. A method according to any one of the claims 18 to 33, wherein the determination is made without reference to a reference image.
- 25 35. A method of determining a measure of video or image quality substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.
- 30 36. Apparatus according to any one of claims 1 to 17 operable in accordance with the method of any one of claims 18 to 35.
37. Apparatus for determining a measure of video or image quality constructed and arranged substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

38. A computer program product having a computer usable medium having a computer readable program code means embodied therein for determining a measure of video or image quality, the computer program product comprising:

5 computer readable program code means for operating according to the method of any one of claims 18 to 35.

39. A computer program product having a computer usable medium having a computer readable program code means embodied therein for determining a measure of video or image quality, the computer program product comprising:

10 computer readable program code means which, when downloaded onto a computer renders the computer into apparatus according to any one of claims 1 to 17, 36 and 37.